

REMARKS

Applicants wish to thank the Examiner for the consideration given to this case to date. Applicants have now had an opportunity to consider the Examiner's Action, and respectfully submit that the subject application, as amended, is in condition for allowance. Originally, claims 1-10 were filed with this application. In Applicants' March 7, 2005 Amendment A, claims 2, 4 and 8-10 were canceled; claims 1, 3 and 5-7 were amended; and claims 11-26 were newly added. Based on the Applicants' March 7, 2005 Amendment A, the Examiner previously allowed claims 1, 3, 5-7 and 11-26. However, the Examiner withdrew the allowance of those claims in the Examiner's September 29, 2005 Office Action.

Claims 18 and 19 are presently amended. Claims 27 and 28 are new. The claim amendments and new claims add no new matter to the subject application. Thus, claims 1, 3, 5-7 and 11-28 are pending in this application.

A. THE EXAMINER'S ACTION

In the Office Action dated September 29, 2005, the Office rejected claims 1, 3, 5-7 and 11-26 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,417,956 issued to Moser, et al. (the "Moser '956 patent").

Specifically, the Examiner stated:

Moser '956 discloses nanophase materials including barium, titanate, zirconia, magnesia, iron oxide, lanthana, alumina and titania, having particle sizes in the nanometer range of from about 1 to 30 nm and are crystalline (see col. 5, ln 23-27). *The materials are produced by the same cavitation process* (see examples and claims). Table II at col. 6 discloses iron oxide (FeO) having particle size of 1-3 nm and *crystallites of about 5%*. It is considered the claimed particle sizes and the *crystallite strain* are met since they fall within the disclosed ranges.

There is no patentable distinction seen between the claimed material and that disclosed by Moser '956.

(Emphasis added).

B. APPLICANTS' RESPONSE TO EXAMINER'S ACTION

Applicants respectfully traverse the Examiner's rejections on at least three bases. First, Applicants respectfully submit that the designation of a material as a "crystallite," and the measure of a material's "crystallinity," are separate and distinct concepts from the existence in a material of "crystallographic strain." The Moser '956 patent does not disclose anything about the crystallographic strain, if any, of the materials disclosed therein. Second, Applicants respectfully disagree with the Examiner's statement that the materials disclosed in the subject application are produced by the same cavitation process as the materials disclosed in the Moser '956 patent.

1. The Materials Disclosed In The Application Are Distinct From The Materials Disclosed In The Moser '956 Patent Because The Materials Disclosed In The Application Have A Crystallographic Strain Of About 0.1 To About 5.0 Percent.

The materials disclosed in the application are distinct from the materials disclosed in the Moser '956 patent because the materials disclosed in the application have a crystallographic strain of about 0.1 to about 5.0 percent.

Each and every pending claim in the present application contains a limitation relating to crystallographic strain. The Moser '956 patent does not teach or disclose crystallographic strain. Rather, the Moser '956 patent refers to "crystallinity" of, in particular, certain metal oxides. More specifically, as pointed out by the Examiner, the iron oxides disclosed in the Moser '956 patent constitute "crystallites of about 5%." The term "crystallinity" is used to express the portion of a pure metal oxide that is in a single crystalline form where all of the ions are in the correct position in a defined crystal lattice. A designation of 100% crystallinity would mean that the material is of a single chemical composition, all of the ions are contained in a single crystallographic form, and there is no amorphous material. Thus, a designation of "about 5%"

crystallinity merely means that, when examined by transition electron microscopy, about 5% of the material that could be observed was crystalline, and the remaining material was either amorphous or very fine, inobservable, crystallites. Stated another way, 5% crystallinity estimates that 5% of the material is in a well-organized crystal and the remainder of the material in the sample is either amorphous material or is too small to be seen by x-ray diffraction.

In contrast, crystallographic strain is the strain, or tension, that a crystal is suffering. Crystallographic systems having no strain are usually well-ordered and all of the ions in the metal system are of the correct ionic radius for that particular class of crystals. Strain may be introduced in several ways. For example, an overly large ion may be synthetically introduced into a lattice position. If the crystal cannot distort, strain will result in the lattice. In nanostructured materials, and more particularly, in metal oxides, ions are in a very small array in a metal-oxygen-metal-oxygen bonding network. This causes the metal ions to be located in microstructures within the tiny crystallite where the bonds are longer than normal. When crystallographic strain is introduced into a material, the material may have increased “free energy,” and, from a thermodynamic perspective, should be more reactive.

Simply put, the 5% crystallinity expressed in the Moser ‘956 patent has no direct relationship to crystallographic strain—a qualitative measure. Rather, the designation of 5% crystallinity merely refers to the amount of material that is crystalline—a quantitative measure. The Moser ‘956 patent contains no disclosure or teaching related to crystallographic strain.

The crystallographic strain disclosed and claimed in the materials produced in the present application is a patentable distinction over the disclosure of the Moser ‘956 patent. As such, Applicants respectfully request that the Examiner withdraw his rejection.

2. The Materials Disclosed In The Subject Application Are Not Produced By The Same Cavitation Process As The Materials Disclosed In The Moser '956 Patent.

With respect to claim 3 specifically and the rest of the claims generally, the materials disclosed in the subject application are not produced by the same cavitation process as the materials disclosed in the Moser '956 patent for the following reasons. First, the Moser '956 patent fails to disclose a cavitation chamber that is capable of creating a cavitation zone. Second, the Moser '956 patent fails to disclose a cavitation chamber that is capable of creating a controllable cavitation zone.

a. *The Moser '956 Patent Fails To Disclose A Cavitation Chamber That Is Capable Of Creating A Cavitation Zone.*

The Moser '956 patent discloses a process for producing nanophase solid state materials in a fluidizer apparatus. More specifically, the Moser '956 patent discloses an apparatus that divides a mixed solution into two streams and then recombines the two streams so that they collide with each other. At the point of collision, the mixed solution undergoes vigorous mixing and high shear forces that act upon the mixed solution to create solid materials having nanosized particles. The resultant particle size is dependent only upon the pressure employed during the collision of the two streams.

The Moser '956 patent further discloses that after such shear forces act on the mixed solution to create the desired particle size, a high temperature calcining of the solid materials is produced during the high state of dispersion. The Moser '956 patent utilizes cavitation in order to produce high temperatures immediately after the shearing step. The pressure drops rapidly from the high pressure utilized during the shearing step to atmospheric pressure, which produces cavitation and thereby releases energy into the precipitated metal material suspended within the liquid and causes the desired calcination.

The Moser '956 patent does not disclose the creation of a cavitation zone because the Moser '956 patent seeks the immediate production and completion of cavitation in order to calcinate the particles immediately. In other words, there is no clear description in the Moser '956 patent that anything other than immediate cavitation for the release of energy is desired. The intersection of the two streams simply cannot fairly be characterized as a "cavitation zone."

In contrast, the materials produced in the subject application may be produced, for example, by the process described in U.S. Patent No. 6,869,586 to Kozyuk, et al. (the "Kozyuk '586 patent"). The U.S. Patent Office specifically considered the Moser '956 patent in its examination of the Kozyuk '586 patent. The Kozyuk '586 patent discloses a means for creating a cavitation zone. The cavitation zone utilized in Applicants' invention is created by controlling the pressure in the cavitation zone (e.g., by providing variable back pressure), thereby being able to create a region (i.e., "zone") of varying length and intensity wherein bubble collapse occurs. Of course, the materials produced in the present application may be produced by any process wherein a controllable cavitation zone is created.

The creation of such a cavitation zone enables the precise adjustment — by variance of bubble size and length of the cavitation zone - of the type of cavitation necessary, depending on the particular nanostructured material sought to be obtained. The creation of a cavitation zone represents a significant benefit over the Moser '956 patent.

b. The Moser '956 Patent Fails To Disclose A Cavitation Chamber That Is Capable Of Creating A Controllable Cavitation Zone.

The Moser '956 patent fails to disclose a cavitation chamber having a means for controlling the cavitation zone. As stated above, the Moser '956 patent requires the immediate production of energy upon attaining the desired particle size so that calcination of the particles occurs. The Moser '956 patent utilizes the creation of high pressure during the shearing step to

create cavitation for the purpose of energy release during the fluid's return to atmospheric pressure. Although cavitation is created due to the fluid's return to atmospheric pressure from a substantially higher pressure, there is no control of cavitation.

Fluid pressure used to cause shear may be increased for the purpose of creating smaller particle sizes. However, there is no indication in the Moser '956 patent that this increased pressure has any effect on cavitation or its control thereof. The Moser '956 patent discloses no other means for creating cavitation except for the pressure drop of the fluid from the combining pressure to atmospheric pressure. Therefore, the Moser '956 patent ultimately discloses the uncontrolled creation and completion of cavitation.

In contrast, Applicants' invention utilizes a means for controlling the cavitation zone disclosed therein. The cavitation zone in Applicants' invention is created and controlled by controlling the pressure in the cavitation zone by providing variable back pressure. Thus, Applicants' invention allows control of the length of the cavitation zone and when bubble collapse will occur. As stated above, the only variable in the Moser '956 patent that implicates control of particle size is the fluid combination pressure, not cavitation or a cavitation zone. Moreover, the Moser '956 patent discloses the final pressure only as a single pressure (i.e., atmospheric pressure). Thus, there clearly is no control of cavitation due to control of back pressure.

In the cavitation utilized in the application, each cavitation zone is controllable depending on the first element selected for the next cavitation zone, the distance between each first and second element, and by the final second element at the end of the multi-stage apparatus. This control allows the precise adjustment of the type of cavitation for the product sought to be

obtained. There is no such cavitation zone creation or control discernible from the Moser '956 patent.

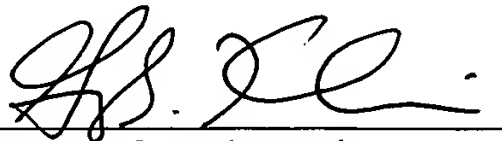
In sum, the materials disclosed in the application are not produced by the same cavitation process as the materials disclosed in the Moser '956 patent. As such, Applicants respectfully request that the Examiner withdraw his rejection.

CONCLUSION

In sum, Applicants respectfully traverse the Examiner's rejections on the grounds that: (1) the crystallographic strain present in the materials produced in the subject application is a patentable distinction over the "crystalline" materials disclosed in the Moser '956 patent; and (2) the materials disclosed in the subject application are not produced by the same cavitation process as the materials disclosed in the Moser '956 patent. As a result, Applicant respectfully asserts that claims 1, 3, 5-7, and 11-28 are in condition for allowance.

No fees are believed due other than the fee for the petition for one-month extension of time. If additional fees are believed due, the Commissioner is hereby authorized to charge the additional fees, or credit any overpayment, to Deposit Account No. **02-2051**, referencing Attorney Docket No. **24961-5**.

Respectfully submitted,



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